Research Paper Series

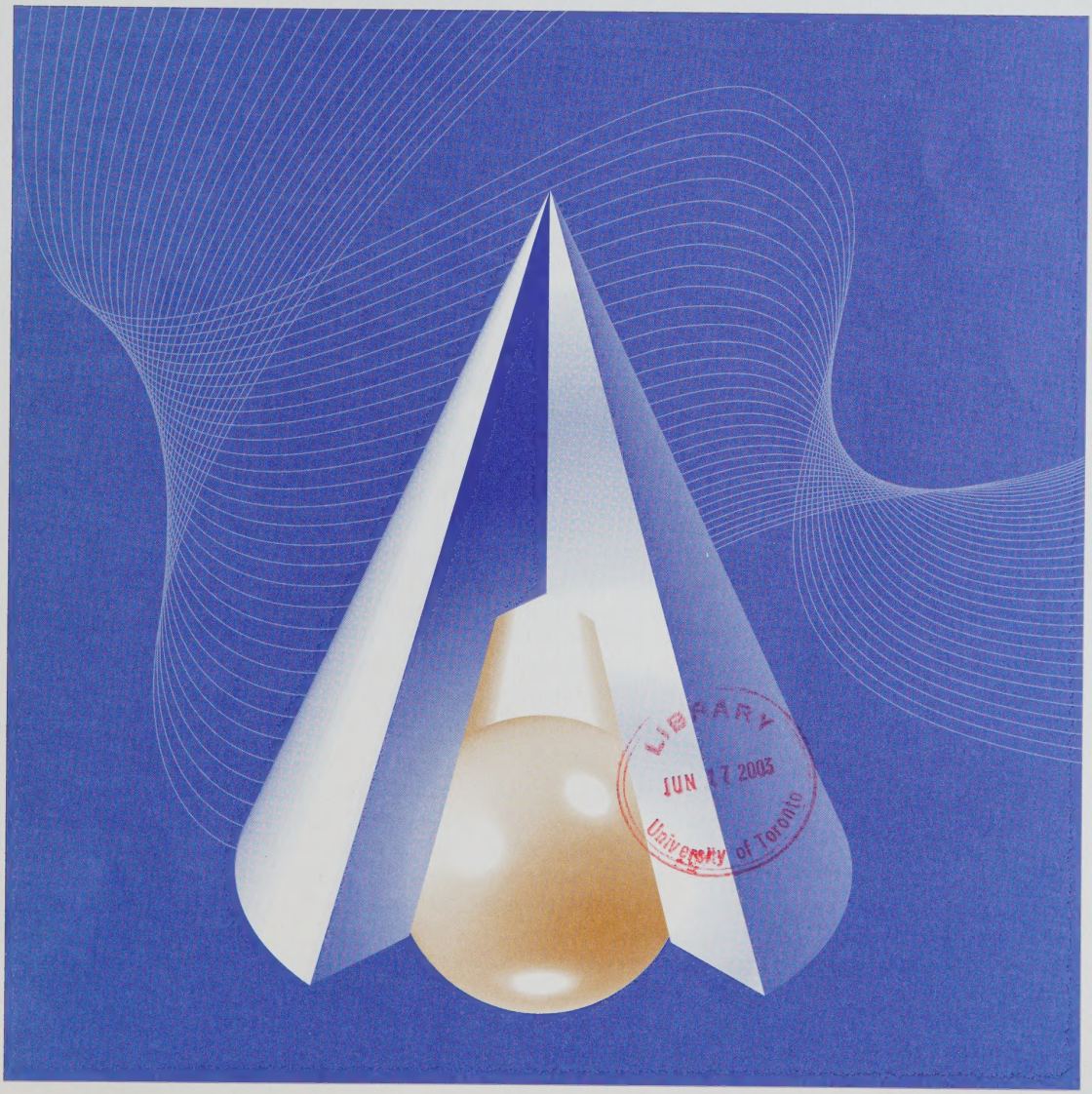
Government Publications

Analytical Studies Branch

Access to College and University: Does Distance Matter?

By Marc Frenette

No. 201



Statistics Canada Statistique Canada

Canada

ANALYTICAL STUDIES
RESEARCH PAPER SERIES

The Analytical Studies Research Paper Series provides for the circulation, on a pre-publication basis, of research conducted by Branch staff, visiting Fellows and academic associates. The Research Paper Series is intended to stimulate discussion on a variety of topics including labour, business firm dynamics, pensions, agriculture, mortality, language, immigration, statistical computing and simulation. Readers of the series are encouraged to contact the authors with comments, criticisms and suggestions. A list of titles appears inside the back cover of this paper.

Papers in the series are distributed to Statistics Canada Regional Offices, provincial statistical focal points, research institutes, and specialty libraries. These papers can be downloaded from the Internet at *www.statcan.ca.*

Publications Review Committee
Analytical Studies, Statistics Canada
24th Floor, R.H. Coats Building
Ottawa, Ontario, K1A 0T6
(613) 951-1804

Access to College and University: Does Distance Matter?

By

Marc Frenette

No. 11F0019 No. 201

ISSN: 1200-5223
ISBN: 0-662-34143-0

Business and Labour Market Analysis
24 -E, R.H. Coats Building, Ottawa, K1A 0T6
Statistics Canada (613) 951-4228
Facsimile Number: (613) 951-5403
Email: frenmar@statcan.ca

June 2003

Helpful comments were received from George Butlin, Louis Christofides, and Garnett Picot. Russell Wilkins was very helpful in providing advice on using the PCCF+ in this and earlier work. All remaining errors are the responsibility of the author.


LIBRARY
7 - 2003
UNIVERSITY OF TORONTO

Table of Contents

Abstract

Previous research suggests that high school students living beyond commuting distance from a university are far less likely to attend, especially if they are from a lower income family. This study asks three follow-up questions. First, do students who live too far to attend university "make-up" for this disadvantage by attending college (if one is nearby)? Second, how does this uptake in college participation differ by class of income? And finally, does distance to school deter students from attending college? After controlling for various factors associated with postsecondary participation such as family income, parental education, sex, and province, students living near a college only, are more likely to attend college than are those living near both a university and a college. The magnitude of this uptake in college participation almost completely counterbalances the difference in university participation, yielding similar postsecondary participation rates between the two groups. The uptake in college participation in outlying areas mainly occurs within groups of students who are from lower and middle-income families—those most negatively affected by living far away from universities. Students living beyond commuting distance from a college are far less likely to attend college, especially if they are from a lower income family. Nevertheless, very few students live beyond commuting distance from a college.

Keywords: postsecondary participation, distance to school, access to postsecondary education

I. *Introduction*

The economic value of a university or college education has long been studied by economists and sociologists[1]. Some more recent work focuses on issues concerning access to postsecondary schooling. Many of these studies suggest that accessing postsecondary schooling may be a challenge for some. In particular, the disadvantaged include students from lower income families (Mehmet (1978), Meng and Sentence (1982), and Christofides, Cirello, and Hoy (2001)), students without a postsecondary educated parent (Butlin (1999) and Christofides, Cirello, and Hoy (2001)), and in recent years, males (Butlin (1999) and Thiessen and Nickerson (1978)).

Some recent work by Frenette (2002) suggests that distance to school also plays an important role in university participation, possibly because students living closer to a university can cut their costs by staying at home to attend the local school. As many as one in five high school students live beyond 80 km of straight-line distance from a university, and are only 58% as likely to attend university as students living within easy commuting distance—less than 40 km (after accounting for differences in family income, parental educational attainment, sex, and province). Moreover, the negative effect of distance is felt far more among students from lower income families, which supports the notion that financial costs are a large part of the reason why distance is such a strong deterrent to attending university.

The current study follows-up on the distance to school work by Frenette (2002) focusing on several issues. First, do students who live too far to attend university "make-up" for this disadvantage by attending college? Second, is this uptake in college participation likely to occur among students from lower income families—those most negatively affected by living far away from universities? Living too far to attend college is generally less of an issue, given that colleges have a strong rural presence. Nevertheless, a third objective of the paper is to assess the role of commuting distance in college participation.

Studies on distance to school and postsecondary participation clearly address questions regarding access—who goes on, and who does not? In particular, the role of distance to school may operate through costs—students who must move away to pursue a postsecondary education will obviously face greater costs than those who stay at home throughout their studies.

Tuition is another (perhaps more obvious) cost component of a postsecondary education, but studying its role in accessibility is not without its difficulties. First, tuition fees may not be exogenous since they may respond to an increased demand for the program. This would lead to a positive correlation between tuition and program participation, which may be counter-intuitive. Moreover, exogenous changes in tuition fees may be largely determined by policy changes at the federal or provincial level, rather than at the institution or program level. This largely reduces the number of natural or random experiments that researchers could draw upon[2]. On the other hand, differences in distance to school are perhaps closer to random experiments. By and large, people do

---

[1] For an overview of recent developments in the literature, see Card (1999).

[2] See Christofides, Cirello, and Hoy (2001) for an example of a study using tuition as an explanatory variable in postsecondary access. In a variety of specifications, the authors do not find a negative and significant effect.

not choose where they grow up. What might make distance to school less random are significant differences in the cognitive abilities of kids in urban and rural areas[3].

Briefly, the results indicate that there is a considerable uptake in college participation among students living near a college only (relative to students living near a university and a college). This uptake in college participation almost fully counterbalances the lower university participation rate among students living near a college only, such that the overall postsecondary participation rate (university and college) is about the same for both groups of students—about 40% each. The uptake is concentrated among students from lower and middle-income families—those most negatively affected by distance in accessing university. Students from upper income families show no signs of an uptake in college participation when living far away from university. Students living beyond commuting distance from college are 37% less likely to attend college than those living within commuting distance. Students from lower income families are affected far more by living beyond commuting distance to college than are other students. It is important to note, however, that only about 3% of high school students live beyond commuting distance to college.

The balance of this paper is straightforward. The next section describes the data. This is followed by a description of the results. And finally, the study is summarized in the last section.

2. The data

The data requirements of this study are very similar to Frenette (2002). First of all, longitudinal data on students "at risk" of attending university is required (including family background characteristics and geography). The Survey of Labour and Income Dynamics (SLID) satisfies these requirements quite effectively. SLID is a longitudinal household survey using the Labour Force Survey (LFS) as a sampling frame. Each panel in SLID is interviewed for up to six years, and a new (overlapping) panel is introduced every three years. The first panel started in 1993 and is now complete up to 1998. The second panel began in 1996 and currently has four years of data (up to 1999). The most important feature of this data set is that the postal code of the students' home while in high school is available.

Which students are "at risk" of attending a postsecondary institution? In most cases, one could simply look at students immediately following high school graduation (12 years of elementary and secondary schooling in most provinces). In Quebec and Ontario, however, university entrance requirements are different. Quebec students must complete at least two years of the university stream of CEGEP, whereas Ontario students must complete their Ontario Academic Credits (OACs, or "grade 13"), at least during the period of study. Since the objective is to look at the student's circumstances while living with his or her family, it would be inappropriate to observe Quebec students while in CEGEP since some students leave home to attend, thus possibly forming their own family[4]. Similar to Frenette (2002), the strategy applied here is to look at all students who are two

[3] In this study, parental education and family income are used to proxy the cognitive abilities of the parents, which may be highly correlated with the cognitive abilities of the students.

[4] In SLID, this depends on whether or not they returned to live with their parents during the year. If they return for at least 30 days, say in the summer, they are still grouped together with their parents; otherwise, they form their own family.

years away from being eligible to attend university in their home province under normal circumstances[5]. This requires looking at students who just completed grade 11 in Quebec and Ontario, and grade 10 in all other provinces (year "t"). Their postsecondary participation patterns (university and college) are then observed over the next two years (up to year "t+2"). The highest level attended is the one that predominates in the final analysis (i.e. a student who attends college and university would be coded as having attended university). The sample is further restricted to young students—between the ages of 15 and 21 years old while in high school.

The second data requirement consists of the postal codes of Canadian postsecondary institutions (universities, university-colleges, and colleges). This information is available from the websites of the Association of Universities and University Colleges of Canada (AUCC) and the Association of Canadian Community Colleges (ACCC)[6]. The AUCC website contains the postal codes of 101 publicly funded universities and university colleges (including all campuses), while the ACCC website contains the postal codes of 377 "community colleges" (including all campuses)[7]. The term "community college" refers to publicly funded non-university postsecondary institutions, excluding trade-vocational schools and business colleges[8]. Many provinces refer to them as community colleges, but they are known as CEGEPs in Quebec and as colleges of applied arts and technology in Ontario[9].

The next step is to calculate the distance between the student's home prior to graduating from high school and the nearest postsecondary institution. The geographic co-ordinates (latitude and longitude) of students are derived from the postal codes of households by using the residential version of Postal Code Conversion File Plus (PCCF+), a program that converts six character postal codes into various geographic units, including latitude and longitude. The institutions' geographic co-ordinates are calculated by using the institutional version of the PCCF+. Assuming the earth to be a perfect sphere with a radius of 6,370.997 km, the formula for the straight-line distance (in km) between the student's home and the nearest postsecondary institution is:

(1) Distance = 6,370.997*arcos[sin(s_latrad)*sin(i_latrad)+cos(s_latrad)*cos(i_latrad)*cos(s_longrad-i_longrad)]

Where "latrad" is the latitude in radians, and likewise for "longrad". The geographic co-ordinates (in degrees and decimals) were converted to radians by dividing by 57.29577951. Note that "s_" denotes the student's location and "i_" denotes the institution's location.

---

[5] Students are eligible to attend college no later than when they are eligible to attend university.

[6] The websites can be visited at http://www.aucc.ca and http://www.accc.ca, respectively.

[7] The list of universities is available in Frenette (2002).

[8] Information on the postal codes of trade schools and business colleges are not available to the author.

[9] In Frenette (2002), only universities of interest to the general student population were included (71 of the original 101, which accounted for about 91% of the entire student body). A non-negligible proportion of colleges are mainly geared to the local labour market, and thus offer programs in a very specific range of disciplines. Eliminating these colleges would have led to a large decline in the number of colleges "at risk" of being attended. Note that in Frenette (2002), university participation patterns were robust to the inclusion of all universities. Thus, the current study includes all colleges and universities in the analysis.

Three groups of students are of interest for this study: those living within commuting distance of a university *and* a college, those living within commuting distance of a college only, and those living beyond commuting distance of a university and a college[10]. Students living beyond 80 km from a postsecondary institution are classified as living beyond commuting distance[11]. Note that this refers to the straight-line distance between the two points, and may correspond to a longer driving distance.

The set of variables used in the analysis include:

Postsecondary participation – categorical variable indicating no postsecondary participation (0), college participation (1), or university participation (2) shortly after high school (up to year "t+2"). Note that students who attended college and university would be coded as having attended university.

Distance to postsecondary institutions – a series of dummy variables indicating whether a university and a college is within commuting distance of the student's home while in high school (the omitted category), only a college is within commuting distance, and neither a university nor a college is within commuting distance.

Family income – dummy variables indicating the income tier of the student's economic family while in high school. Family incomes are classified by tiers within the five standard area sizes of residence in order to (partially) account for differences in the cost of living, as well as the family's relative socio-economic status in the community[12]. The five sizes include rural, small urban (under 30,000 people), 30,000-99,999 people, 100,000-499,999 people, and 500,000 or more people. The middle income tier is the omitted category. Note that the income is adjusted for the size of the family in order to create a per capita income measure that accounts for economies of scale associated with larger families. The precise adjustment consists of dividing family income by the square root of the size of the family.

Parental education – dummy variables indicating the highest level of educational attainment of the parents (the highest level attained by either parent is a university degree, a college diploma, or no postsecondary certificate/don't know).

Female – a dummy variable to account for differences in postsecondary participation rates between the sexes.

Province – a series of dummy variables indicating the province the student lived in while in high school, with Ontario as the omitted category. This can capture inherent differences in postsecondary participation across provinces, either due to differences in student composition, differences in

[10] A very tiny proportion of students live near a university, but not near a college. These cases are omitted since no substantial analysis could be performed on them.

[11] Frenette (2002) had three distance categories: 0-40 km (within commuting distance), 40-80 km (possibly beyond commuting distance), and 80 km or more (beyond commuting distance). The smaller cell sizes in the current study necessitated the grouping of the 40-80 km and 80 km or more categories.

[12] The results are robust to calculating the family income tier across all of Canada.

economic conditions across provinces, differences in tuition fees across provinces, or differences in the academic requirements for college and university admittance (especially important for Quebec and Ontario students).

Year – a series of dummy variables indicating the year up to which we observe postsecondary attendance (year "t+2"). This can capture trends in other factors that may affect postsecondary participation (e.g. improving economic conditions or rising tuition fees in the 1990s).

The sample means of these variables appear below in Table 1. An equal proportion of students attended university and college shortly after high school (about one in five attended each). Note that some students who attended university may have also attended college, but the highest level attended predominates. About 40% of the sample comes from families in the top income tier (within an area of a given size), but this is due to the implied age of the parents in the sample relative to the general population—by design, they have at least one child who is between the ages of 15 and 21 years old. Most students are within commuting distance (less than 80 km) of a university and a college (83%). Another 13.5% are within commuting distance from a college only, while only 3.4% are out-of-commuting distance from either type of institution. Recall that students who were within commuting distance to a university but not a college are excluded from the study since there are very few of these cases. The sample under-represents Quebec students simply because family information had to be garnered by looking back one year (since some grade 11 students may have already left the home to attend CEGEP or to work). This eliminated the first wave of the first two panels (1993 and 1996, respectively), as well as any new cross-sectional top-ups (which are added to the sample to account for attrition). The sample over-represents the year 1998 (regarding postsecondary participation) since the SLID panels start overlapping in 1996 (the high school students are sampled in 1996, and their postsecondary participation up to 1998 is observed). The sample drops again in 1999 since the first panel ended in 1998. The sampling weights are designed to adjust for this asymmetry.

Table 1: Sample means	
Highest education level attended = university	0.192
Highest education level attended = college	0.200
Top income tier	0.403
Middle income tier	0.335
Bottom income tier	0.263
University and college nearby	0.831
College nearby	0.135
No university/college nearby	0.034
Highest educational level of either parent = university degree	0.158
Highest educational level of either parent = college diploma	0.242
Neither parent has a postsecondary certificate or don't know	0.601
Female	0.475
Newfoundland and Labrador	0.029
Prince Edward Island	0.005*
Nova Scotia	0.039
New Brunswick	0.034
Quebec	0.116
Ontario	0.431
Manitoba	0.043
Saskatchewan	0.046
Alberta	0.108
British Columbia	0.148
1995	0.114
1996	0.185
1997	0.158
1998	0.359
1999	0.186
N	2,065

Note: In this and all following tables, the term"nearby" refers to less than 80 km of straight-line distance.

* Estimate should be viewed with caution.

3. Results

3.1 The geographic proximity to colleges and universities

Table 1 answered the question "Where are high school students located relative to the nearest college and/or university?" Due to small provincial sample sizes, this question could not be investigated at the provincial level. However, by using the 1996 SLID cross-sectional sample, the location of the entire population relative to universities/colleges can be ascertained. Table 2 shows the distribution of the population by distance to the nearest university and/or college for all Canadians and for each province.

Table 2: Distribution of population in 1996 by distance to nearest university and/or college

Province	Sample	Type of institution nearby				
		University or college nearby			Neither university nor college nearby	Total
		University and college	College only	Total		
Newfoundland and Labrador	3,588	0.579	0.347	0.926	0.074	1.000
Prince Edward Island	1,875	0.907	0.093	1.000	0.000	1.000
Nova Scotia	4,790	0.957	0.043	0.999	0.001	1.000
New Brunswick	4,535	0.858	0.142	1.000	0.000	1.000
Quebec	13,470	0.905	0.064	0.969	0.031	1.000
Ontario	20,462	0.921	0.073	0.993	0.007	1.000
Manitoba	4,845	0.789	0.106	0.895	0.105	1.000
Saskatchewan	4,729	0.488	0.478	0.965	0.035	1.000
Alberta	6,069	0.771	0.162	0.933	0.067	1.000
British Columbia	6,367	0.848	0.124	0.971	0.029	1.000
Canada	70,730	0.867	0.106	0.973	0.027	1.000

Note: Excludes those with only a university nearby.

First, note that the national proportions for all Canadians (Table 2) are quite close to the national proportions for all students (Table 1). Frenette (2002) found that there was tremendous variation in the proximity of universities to Canadians by province, with Saskatchewan ranking the lowest, followed by Newfoundland and Labrador[13]. We now see that the majority of the population in Newfoundland and Labrador and Saskatchewan is nevertheless within commuting distance to a university *or* a college, although many of their residents are within commuting distance to a college only. At least 89% of residents in any province live within commuting distance of a university or a college (see the "Total" column under "University or college nearby"). Ranking highest are Prince Edward Island, Nova Scotia, and New Brunswick (100% each), followed by Ontario (99%). Ranking lowest are Manitoba (89%), followed by Newfoundland and Labrador and Alberta (93%). In general, the vast majority of the Canadian population lives near a university or a college. Most of the analysis will thus focus on comparing the participation rates of students who live near a university and a college to those of students who live near a college only.

3.2 Distance to school and postsecondary participation

3.2.1 Descriptive analysis

Looking first at the raw data, Table 3 shows the postsecondary participation rates by the type of institution nearby (within 80 km). Students within 80 km of a university and a college are equally as likely to attend university or college (about one in five, or 20%, attend each type of institution). When only a college is within 80 km, the university participation rate falls to 13%, and the college participation rate rises to about 22%. On the surface, it appears that the uptake in college participation is quite low compared to the decline in university participation; however, these results don't account for differences in observable characteristics. As it turns out, Quebec students play a

[13] Note that Frenette (2002) included only 71 of the 101 universities. This study includes all 101 universities. The results in Frenette (2002) are very robust to this restriction.

large role in these results for two reasons: they are far more likely to attend college (CEGEP)[14], and a relatively high proportion of them live near a university and a college (Table 2). By excluding Quebec students, the uptake in college participation in outlying areas almost fully counterbalances the decline in university participation (see the bottom of Table 3). In the regression analysis, Quebec students will be included, but the province of residence will serve as a control variable.

Table 3: University and non-university postsecondary participation by distance to nearest university/college

Type of institution nearby	Sample	Proportion attending		
		University	College	University or college
All students				
University and college	1,489	0.205	0.200	0.404
College only	448	0.130	0.217	0.347
Neither	128	0.112	0.134	0.246
Quebec students excluded				
University and college	1,346	0.229	0.146	0.376
College only	430	0.136	0.204	0.340
Neither	113	0.136	0.070	0.205

Another interesting result from Table 3 is that students living beyond commuting distance from a college are far less likely to attend college than those living within commuting distance. Recall, however, that only 3.4% of students live beyond commuting distance from a college (Table 1), so it is perhaps less of an issue than distance to university.

3.2.2 Econometric analysis

In this section, the role of distance to school in postsecondary participation is analysed more closely in a multinomial logit model. The general model estimated is:

$$(2)\ \text{Ln}\ [P_{ij}/(P_{i0})] = \mathbf{x}_i\beta_j + \xi_i$$

Where "P" is the probability of postsecondary participation, "**x**" is a vector of regressors, and "ξ" is a random disturbance term. The subscript "i" denotes the student, while the subscript "j" denotes the type of postsecondary schooling (0 = no postsecondary; 1 = college; 2 = university). The reference outcome is no postsecondary schooling (j = 0).

3.2.2.1 Model 1: No distance

The explanatory variables included in the first model are family income, parental education, sex, province, and the year by which we observe whether the student attended postsecondary schooling or not. Controls for distance to school will be added later. The results are shown below in Table 4.

[14] Many Quebec students are still in CEGEP two years after grade 11, even if they eventually plan on attending university. As Frenette (2002) points out, a longer time horizon would be necessary to more accurately depict the particular situation in Quebec.

Table 4: Postsecondary attendance Model 1— no distance variables (multinomial logit)

	University attendance (PS = 2)	College attendance (PS = 1)
Intercept	-2.017 **	-1.454 **
	(-4.66)	(-4.73)
Top income tier	0.352	0.195
	(1.74)	(1)
Bottom income tier	-0.687 **	-0.055
	(-2.69)	(-0.24)
Highest educational level of either parent = university degree	1.383 **	0.125
	(5.6)	(0.53)
Highest educational level of either parent = college diploma	0.383	-0.175
	(1.59)	(-0.8)
Female	0.575 **	0.223
	(3.21)	(1.33)
Newfoundland and Labrador	0.341	-0.627 *
	(1.29)	(-2.04)
Prince Edward Island	0.588	-0.955
	(1.61)	(-1.71)
Nova Scotia	0.447	-0.884 *
	(1.6)	(-2.39)
New Brunswick	0.243	-0.343
	(0.94)	(-1.12)
Quebec	-1.558 **	1.587 **
	(-3.11)	(6.01)
Manitoba	0.016	-0.733 *
	(0.05)	(-2)
Saskatchewan	-0.238	-0.534
	(-0.89)	(-1.51)
Alberta	-0.601 *	-0.589 *
	(-2.12)	(-2.16)
British Columbia	-0.858 **	-0.125
	(-2.65)	(-0.48)
Year 1996	0.832	0.120
	(1.94)	(0.37)
Year 1997	0.636	-0.206
	(1.55)	(-0.61)
Year 1998	0.306	0.226
	(0.84)	(0.85)
Year 1999	0.061	0.070
	(0.16)	(0.23)
N	2,065	
-2*log(likelihood ratio)	3,449.60	

Dependent variable (PS):
0 = no university/college attendance
1 = college attendance
2 = university attendance

Notes: z statistics in parentheses; ** significant at 1%; * significant at 5%;

Relative to the middle income tier, students in the top income tier are more likely to attend university, while students in the bottom tier are less likely to attend. The magnitude of the coefficient on the bottom tier variable is not only larger than that of the top tier (in absolute value), it is also significant at 1% (compared to 10% for the top tier). In terms of college attendance, income doesn't seem to play a strong role, as the coefficients are small in magnitude and not statistically significant.

Parental possession of a university degree is associated with a higher probability of university participation, but having a college educated parent only has a small positive impact on the likelihood of attending university (relative to not having a postsecondary educated parent). For college attendance, parental education seems to matter very little.

Consistent with published statistics from the 1990s, females are more likely to attend university than males (significant at 1%)[15]. Females are only slightly more likely to attend college than males, however, and the difference is not statistically significant.

Many provincial coefficients are not significant, indicating that students in these provinces are about as likely as Ontario students (the reference category) are to attend university or college. The one province that stands out is Quebec. Compared to Ontario, students in Quebec are far less likely to attend university, but are far more likely to attend college. This might be partly because many Quebec students are still in CEGEP two years after completing grade 11, even if they plan on pursuing a university education. A longer time frame would be necessary to more accurately depict the situation in Quebec, but the focus of this paper is on the national results (using province as one of many control variables).

3.2.2.2 Model 2: Add distance to school

Students who live beyond commuting distance from a university are less likely to attend university (Frenette (2002)). If these students are within commuting distance to a college, do they "make up" for this disadvantage by being more likely to attend college? In Model 2, a distance to school variable is added to answer this question. All other variables are the same as in the original model shown in Table 4. The results are shown below in Table 5.

[15] See CANSIM tables 580602, 580603, 580701, and 580702 for more details on university enrolment trends.

Table 5: Postsecondary attendance Model 2—distance variables added (multinomial logit)		
	University attendance (PS = 2)	College attendance (PS = 1)
Intercept	-1.990 **	-1.470 **
	(-4.59)	(-4.76)
Top income tier	0.360	0.209
	(1.77)	(1.07)
Bottom income tier	-0.672 **	-0.056
	(-2.64)	(-0.24)
College nearby	-0.526 **	0.319
	(-2.64)	(1.65)
No university/college nearby	-0.539	-0.707 *
	(-1.64)	(-1.98)
Highest educational level of either parent = university degree	1.362 **	0.110
	(5.49)	(0.46)
Highest educational level of either parent = college diploma	0.371	-0.186
	(1.53)	(-0.85)
Female	0.576 **	0.208
	(3.2)	(1.24)
Newfoundland and Labrador	0.507	-0.676 *
	(1.87)	(-2.19)
Prince Edward Island	0.561	-0.944
	(1.53)	(-1.69)
Nova Scotia	0.426	-0.878 *
	(1.51)	(-2.37)
New Brunswick	0.278	-0.382
	(1.07)	(-1.25)
Quebec	-1.559 **	1.639 **
	(-3.1)	(6.13)
Manitoba	0.093	-0.649
	(0.31)	(-1.76)
Saskatchewan	-0.003	-0.679
	(-0.01)	(-1.93)
Alberta	-0.546	-0.563 *
	(-1.91)	(-2.06)
British Columbia	-0.812 *	-0.128
	(-2.49)	(-0.48)
Year 1996	0.845 *	0.119
	(1.96)	(0.37)
Year 1997	0.648	-0.226
	(1.58)	(-0.66)
Year 1998	0.329	0.206
	(0.9)	(0.78)
Year 1999	0.084	0.068
	(0.22)	(0.23)
N	2,065	
-2*log(likelihood ratio)	3,432.65	
Dependent variable (PS):	0 = no university/college attendance 1 = college attendance 2 = university attendance	
Notes: z statistics in parentheses; ** significant at 1%; * significant at 5%;		

First, note that the coefficients on the explanatory variables that were included in the first model exhibit similar behaviour when distance to school is added. In other words, their sign is intact, and the magnitude and significance is largely unaltered. Relative to students with a university and a college nearby, students with only a college nearby and those with neither a college nor a university nearby are less likely to attend university (by roughly the same margin, given the equal magnitude of the coefficients). Students with a college nearby are more likely to attend college than are students with a university and a college nearby (with a significance level of 10%). Thus, there is an uptake in college attendance among students living away from universities, but who are nevertheless near colleges. Students who live away from colleges, on the other hand, are less likely to attend college than students who are near a college, whether a university is nearby or not (both significant at 5%).

3.2.2.3 Model 3: Interact family income with distance to school

Since we know that the students most likely to be disadvantaged in accessing university as a result of commuting distance are those from lower income families (Frenette (2002)), it would be instructive to know if these students are taking advantage of their proximity to college (to make up for their disadvantage in accessing university). To answer this question, the distance variables are interacted with the income variables in Model 3, which is shown below in Table 6.

Table 6: Postsecondary attendance Model 3—distance and income interacted (multinomial logit)		
	University attendance (PS = 2)	College attendance (PS = 1)
Intercept	-1.997 **	-1.510 **
	(-4.57)	(-4.72)
Top income tier	0.346	0.287
	(1.51)	(1.28)
Bottom income tier	-0.571 *	-0.068
	(-2.05)	(-0.24)
Top income tier × college nearby	-0.401	-0.096
	(-1.3)	(-0.31)
Middle income tier × college nearby	-0.358	0.501
	(-1.27)	(1.59)
Bottom income tier × college nearby	-1.601 **	0.568
	(-3.28)	(1.55)
Top income tier × no university/college nearby	-0.213	-0.587
	(-0.53)	(-1.06)
Middle income tier × no university/college nearby	-1.175	-0.656
	(-1.87)	(-1.18)
Bottom income tier × no university/college nearby	-0.521	-1.023
	(-0.5)	(-1.27)
Highest educational level of either parent = university degree	1.377 **	0.101
	(5.52)	(0.42)
Highest educational level of either parent = college diploma	0.379	-0.179
	(1.57)	(-0.82)
Female	0.585 **	0.212
	(3.25)	(1.26)
Newfoundland and Labrador	0.504	-0.703 *
	(1.84)	(-2.26)
Prince Edward Island	0.546	-0.948
	(1.5)	(-1.69)
Nova Scotia	0.410	-0.874 *
	(1.46)	(-2.36)
New Brunswick	0.249	-0.376
	(0.96)	(-1.22)
Quebec	-1.568 **	1.646 **
	(-3.11)	(6.1)
Manitoba	0.073	-0.628
	(0.24)	(-1.7)
Saskatchewan	0.001	-0.696 *
	(0)	(-2.04)
Alberta	-0.574 *	-0.562 *
	(-1.99)	(-2.04)
British Columbia	-0.833 *	-0.115
	(-2.55)	(-0.43)
Year 1996	0.846 *	0.124
	(1.97)	(0.38)
Year 1997	0.648	-0.215
	(1.58)	(-0.63)
Year 1998	0.329	0.209
	(0.9)	(0.79)
Year 1999	0.071	0.079
	(0.19)	(0.27)
N	2,065	
-2*log(likelihood ratio)	3,423.72	
Dependent variable (PS):	0 = no university/college attendance 1 = college attendance 2 = university attendance	
Notes: z statistics in parentheses; ** significant at 1%; * significant at 5%;		

To focus on the question of college uptake in outlying areas by income tier, we need to examine the college attendance coefficients. More specifically, we need to look at the income/distance interaction coefficients. For the top income tier, students near a college only are no more likely to attend college than students near a university and a college (the coefficient on the "top income tier*college nearby" variable is slightly negative). The uptake in college attendance appears to occur among students from lower and middle-income families. Both the "bottom income tier*college nearby" and the "middle income tier*college nearby" are positive, although not quite significant at the 10% level.

For all three classes of income, students living far away from colleges are less likely to attend college than students living near both types of institutions. Recall from Model 2 that the coefficient is significant at 5% when it isn't interacted with family income. Note that the sample size of each class of income in this distance category is very low, which might be one reason why the results are not significant. Another reason is that the reference group consists of students near a college and a university, many of whom choose university over college. Students from lower and middle-income families are less likely to attend college when one isn't nearby than when one is nearby (but a university is not nearby), with a significance level of 10%.

3.2.3 The magnitude of the role of distance to school

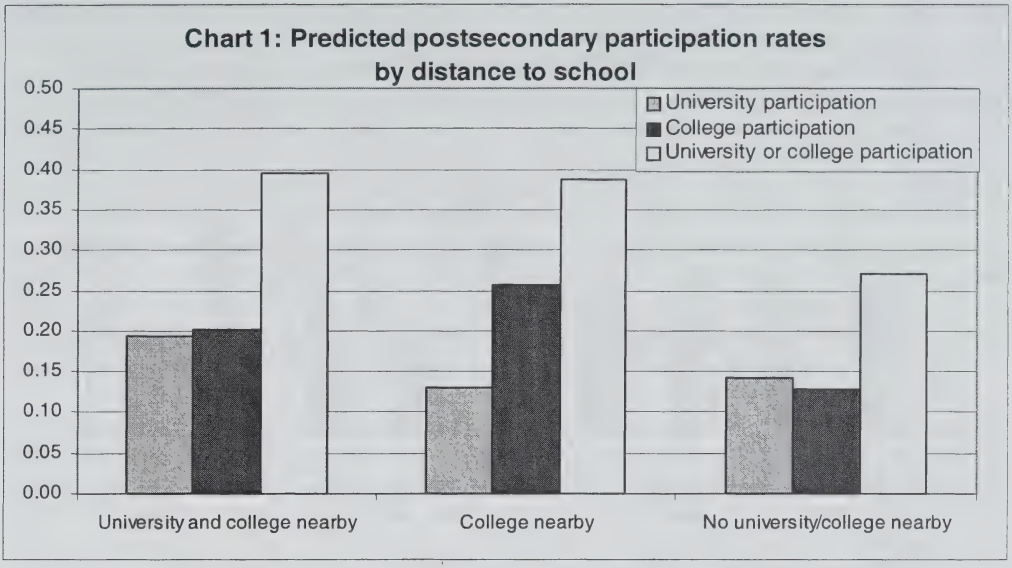
So far, we have examined the role of distance to school in a series of multinomial logit models. To better appreciate the magnitude of this role, predicted probabilities of postsecondary participation were generated from the regressions through the general formula:

(3) $P_{ij} = \exp(\mathbf{x_i}'\mathbf{b_j})/[1 + \Sigma_k \exp(\mathbf{x_i}'\mathbf{b_k})]$, k = 1 to 2 (college =1; university =2)

Where "P_{ij}" is the predicted probability of an individual "i" attending postsecondary schooling "j", and "$\mathbf{x_i}'\mathbf{b}$" is a linear combination of the regressor variables (at a given set of values $\mathbf{x_i}'$) each multiplied by their estimated regression coefficient in **b**. The predictions are calculated at the individual level, and then averaged out over the entire sample (based on various scenarios of interest). See Frenette (2002) for the advantages of this technique.

Chart 1 shows the predicted probabilities of university and college participation for students living in the three distance categories. The predicted probability of participating in any type of postsecondary schooling is also shown. This is simply the sum of the university and college predicted probabilities. All probabilities in Chart 1 are based on the coefficients estimated in Model 2.

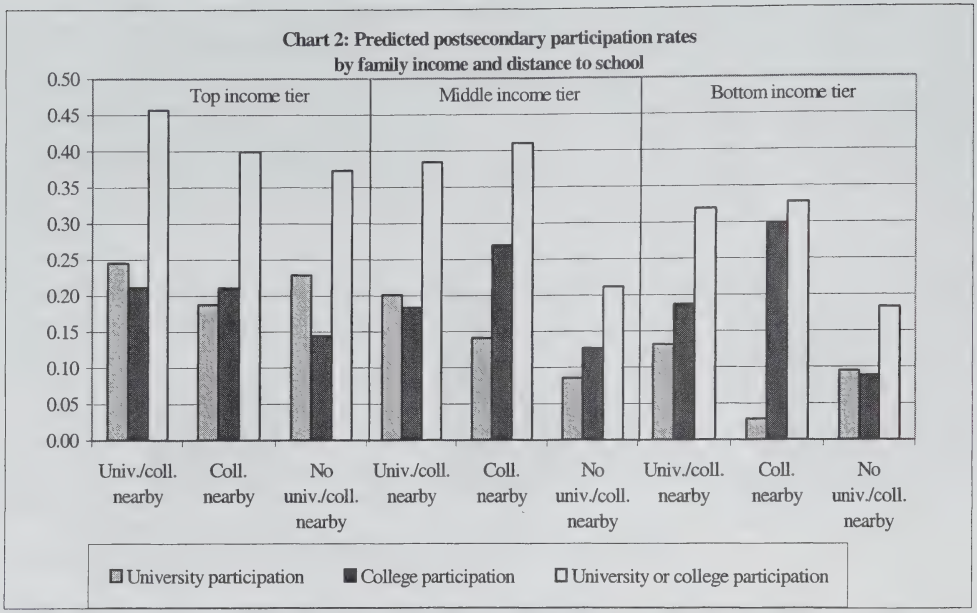
When a university and a college are nearby, students are as likely to attend either type of school. When only a college is nearby, the university participation rate falls considerably, but the college participation rate increases substantially. On balance, the overall postsecondary participation rate (university and college combined) is about the same for both types of students—about 40%. Hence, despite the fact that students who live beyond commuting distance from a university are less likely to attend university, they are just as likely to pursue postsecondary schooling in general—as long as a college is nearby. Whether this is the first choice of these students is obviously a question that cannot be answered within the scope of the data at hand.



For the group of students who live beyond commuting distance from a college, the college participation rate is 37% lower than that of students living within commuting distance[16]. This suggests that distance presents a challenge to some students contemplating a college education. Nevertheless, only 3.4% of students in the sample live far away from a college. As outlined in Frenette (2002), distance to school presents a challenge to far more potential university students—about one in five.

Chart 2 shows the postsecondary participation rates for the three income tiers, which are generated from Model 3. We see that for students from families in the top income tier, the college participation rate is the same whether they are near a university and a college, or just near a college. Since the university participation is lower for these students when they are beyond commuting distance, we also see a moderate decline in their overall participation rate. Students from families in the middle and bottom income tiers, on the other hand, are far more likely to attend college when living near a college only (relative to students in the same income tier and living near a university and a college). The overall postsecondary participation rate is about the same for students in lower and middle-income families whether they are near just a college or near both a university and a college.

[16] The college participation rate among all students living near colleges had to be calculated to obtain this figure. To this end, it was necessary to calculate a population-weighted average of the predicted college participation rates among students living near both types of institutions and those living near a college only.



College attendance is lower for students who live beyond commuting distance from a college regardless of their family income, but this negative effect is felt far more among students from lower income families. Recall from Table 6, however, that the coefficients generating these differences are not statistically significant.

4. Conclusion

Previous work has found that high school students living beyond commuting distance to university are far less likely to attend shortly after high school than those living within commuting distance, especially among students from lower income families. This study seeks to answer three follow-up questions. First, are students who live far from universities more likely to attend college if one is nearby, even if this may or may not be their first choice? And given that lower income students are so negatively affected by distance in accessing universities, do they "make up" for this disadvantage by attending college? Finally, does distance to college pose a substantial barrier to students contemplating a college education?

The results indicate that students living beyond commuting distance from a university are far more likely to attend a college, as long as one is nearby. As a result, postseconday participation rates are about the same for students living near a college or both a college and a university—about 40%. This uptake in college attendance occurs among students from lower and middle-income families only—those most negatively affected by distance in accessing universities. Students from upper income families are no more likely to attend college when this is the only choice that is nearby.

Students who live beyond commuting distance from a college are 37% less likely to attend than those who live closer. As with university attendance, the negative effect of distance to college is felt far more among students from lower income families. Nevertheless, distance to school is generally less of an issue for colleges than it is for universities. Only 3% of students live beyond commuting distance to a college, while one in five students live beyond commuting distance to a university.

The patterns of university and college participation by family income and distance to school (Chart 2) are consistent with the notion that added costs deter students in less favourable economic circumstances from pursuing a university or college education. When no university is nearby, students from lower income families are far less likely to attend than students from upper income families. The same can be said when no college is nearby, although this situation is far less common. In both cases, however, the impact on students from middle-income families lies somewhere in between the impact on students from lower and upper income families.

The implications of the findings in this study are not amenable to a straightforward interpretation. On the one hand, it is encouraging to see that the overall postsecondary participation rate is about the same whether a university is nearby or not, as long as the college alternative is within reasonable distance. Furthermore, some may argue that colleges serve a local purpose by training students for jobs in the area. But if this is the case, it is possible that their graduates are less geographically mobile than are university graduates (who often compete in national, and sometimes international labour markets). Finnie (1999) finds that college graduates were generally about half as likely to move provinces in the years following graduation than were university graduates in the 1980s and 1990s[17]. Moreover, it is important to realise that from the student's perspective, colleges and universities serve different purposes. Students who target a college education generally have different career goals than those who plan on attending university. Some students may have goals that can only be fulfilled by a university education, but can not attend a university because it would require for them to move away from home. Since they have fewer choices available to them, these students are less likely to meet their goals than students who have both options available.

[17] This finding is probably not explained by the fact that university students often must move provinces to attend university, and then may move back to their home province to work, since university graduates are also more mobile than college graduates between two and five years following graduation.

Bibliography

Butlin, G. (1999). "Determinants of postsecondary education", *Education Quarterly Review,* Catalogue no. 81-003-XPB, *5* (3), pp. 9-35.

Card, D. (1999). "The causal effect of education on earnings", in *Handbook of labor economics*, Volume 3, O. Ashenfelter and D. Card, eds., North-Holland, Amsterdam.

Christofides, L., Cirello, J., and Hoy, M. (2001) "Family income and postsecondary education in Canada", *The Canadian Journal of Higher Education*, *31* (1), pp. 177-208.

Finnie, R. (1999) "A dynamic analysis of the school-to-work transition of post-secondary graduates in Canada", Research paper R-99-14E, Applied Research Branch, Strategic Policy, Human Resources Development Canada.

Frenette, M. (2002) "Too far to go on? Distance to school and university participation", Statistics Canada, Analytical Studies Research Paper Series, 11F0019MIE2002191.

Mehmet, O. (1978). *Who benefits from the Ontario university system?* Toronto: Ontario Economic Council.

Meng, R., and Sentence, J. (1982). "Canadian universities: Who benefits and who pays?", *The Canadian Journal of Higher Education*, *12* (3), pp. 45-58.

Thiessen, V. and Nickerson, C. (1978). *Canadian gender trends in education and work.* Ottawa: Human Resources Development Canada.